

REMARKS

In view of the above amendments and following remarks, reconsideration and further examination are requested.

In the Final Rejection mailed July 18, 2007: claims 34, 35, 52 and 53 were rejected under 35 U.S.C. § 102(a) or 102(e) as being anticipated by Emesh et al.; claims 34-36, 41-43, 48, 49, 52 and 53 were rejected under 35 U.S.C. § 102(e) as being anticipated by Lee et al.; claims 34, 40, 46, 51 and 53 were rejected under 35 U.S.C. § 102(b) as being anticipated by WO '443; claims 34, 39, 47 and 50-53 were rejected under 35 U.S.C. § 102(e) as being anticipated by Colgan et al.; claims 34, 35, 52 and 53 were rejected under 35 U.S.C. § 102(b) as being anticipated by WO '426; and claims 37, 38, 44 and 45 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Lee et al. in view of Brown et al.

In view of the positions taken by the Examiner, claims 34 and 38-41 have been amended, and claims 36, 37 and 42-53 have been canceled.

Specifically, claim 34 has been amended as follows:

A substrate processing apparatus for cleaning a substrate, comprising:
a substrate holder for holding a substrate having a copper film thereon;
a processing head having anodes and cathodes, arranged alternately along at least one direction, so as to face the substrate when held by said substrate holder, said anodes and cathodes being away from the substrate when held by said substrate holder;
a processing liquid supply section for supplying a processing liquid containing an electrolyte between the substrate, when held by said substrate holder, and said anodes and cathodes; and
a power source for applying a voltage between said anodes and cathodes so as to generate micro-bubbles in the processing liquid when between the substrate and said anodes and cathodes; and
an ultrasonic transducer for emitting ultrasonic waves to the processing liquid, when between the substrate and said anodes and cathodes, so as to collapse the micro-bubbles, said ultrasonic transducer being on said processing head so as to face the substrate

when held by said substrate holder, and said ultrasonic transducer and said anode and cathodes being arranged next to each other.

The substrate processing apparatus according to the present invention uses a combination of a bipolar phenomenon and micro bubbles. Voltage is applied between anodes and cathodes, facing a substrate with a small distance, to oxidize conductive material on the substrate by action of the bipolar phenomenon, thereby electrically dissolving and removing the conductive material. In addition to this action, ultrasonic waves are applied to gas bubbles, generated at the anodes, to collapse or disperse the gas bubbles. This action of the gas bubbles removes non-conductive particles, an organic material, and the like on the substrate. In this manner, the combination of the bipolar phenomenon and the micro bubbles permits removal of not only the conductive material, but also non-conductive material such as organic material.

Currently amended claim 34 is believed to clearly state use of such bipolar phenomenon. Specifically, claim 34 recites that the anodes and cathodes are away from the substrate when held by the substrate holder.

Currently amended claim 34 further recites that the ultrasonic transducer is to face the substrate, and that the ultrasonic transducer and the anodes and cathodes are arranged next to each other. With these arrangements, generation and collapse of micro bubbles occur alternately near a surface of the substrate, whereby the surface can be cleaned efficiently.

Accordingly, currently amended claim 34 includes the subject matter added by former claims 36 and 37, with the additional limitations of the anodes and cathodes being away from the substrate when held by the substrate holder, and the ultrasonic transducer and anodes and cathodes being arranged next to each other. Accordingly, the rejection of claim 37 will be addressed as it pertains to currently amended claim 34.

Claim 37 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Lee et al. in view of Brown et al. Specifically, the Examiner recognized that Lee et al. fails to teach an ultrasonic transducer on a processing head, and thus relied upon Brown et al. to remedy this deficiency of Lee et al. For reasons to follow, it is respectfully submitted that a combination of Lee et al. and Brown et al. would not result in the invention as recited in currently amended claim 34.

The Examiner has equated oscillator 32 of Brown et al. to the claimed ultrasonic transducer; however, oscillator 32 does not face a substrate, but rather faces polishing pad 20. Similarly, ultrasonic energy emitter 1112 of Lee et al. faces polishing pad 1182 rather than substrate 110. Additionally, neither Lee et al. nor Brown et al. discloses or suggests the positional relationship between the ultrasonic transducer and anodes and cathodes as required by claim 34. That is, the energy emitter 1112 of Lee et al. is not next to anodes and cathodes, and the oscillator 32 of Brown et al. is not next to anodes and cathodes.

Thus, claim 34 is not obvious over a combination of Lee et al. and Brown et al.

The other references do not remedy these deficiencies of Lee et al. and Brown et al., whereby claims 34, 35 and 38-41 are allowable over the relied-upon references either taken alone or in combination.

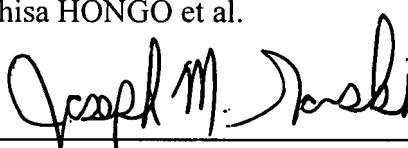
In view of the above amendments and remarks, it is respectfully submitted that the present application is in condition for allowance and an early Notice of Allowance is earnestly solicited.

If after reviewing this Amendment, the Examiner believes that any issues remain which must be resolved before the application can be passed to issue, the Examiner is invited to contact the Applicants' undersigned representative by telephone to resolve such issues.

Respectfully submitted,

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